

**Applied Physics Seminar,  
October 6, 2010  
335 West Hall  
12-1 PM**

**“Counter-rotating optical vortex photons for atom optics”**

**Yisa Rumala**, Applied Physics Graduate student

Abstract: Optical vortex photons have a wide range of applications including atom optics and quantum networking. These applications emanate from the rich spatial degree of freedom that the individual photons possess which can be tailored into various optical geometries. In this work, we generate optical photons which possess integer values of orbital angular momentum by imprinting a helical phase front on the transverse spatial structure of a Gaussian laser mode. This forms an optical vortex. We create a superposition of counter-rotating optical vortex photon pairs with a modified Mach-Zehnder interferometer and perform a detailed analysis of the interferometer as well as its spatial mode. The vortex superposition resembles an optical pin-wheel. One of the items we intend to do is to use the angular variation of the intensity pattern as a phase grating to diffract ultra-cold atoms (e.g. a Bose-Einstein Condensate) into a coherent superposition of external atomic angular momentum states, which may open up new possibilities in rotation sensing.